interconnect chip ("PIC") for use in interconnecting electronic components "formed on" the printed circuit board recited in each of Claims 20 and 23 has been changed to recite a PIC for use in interconnecting electronic components "provided over" the board so that the claims clearly cover the typical situation in which the formation of the electronic components is complete when they are connected to the board.

Similar to how the analogous part of Claim 23 is worded, Claim 20 has also been amended to recite that the segments of each segmented conductive lead are "electrically separate" in order to clarify the electrical nature of the segmentation. In addition, the "means for electrically interconnecting" conductive leads in the PIC of Claim 20 has been changed to "means for programmably interconnecting" to emphasize where the programmable nature of the PIC arises. The remaining changes to Claims 20 and 23 eliminate some unnecessary language and clarify the relationship between the PIC's surface, or substrate, on one hand, and the pads and conductive leads, on the other hand.

The "means for electrically interconnecting" in dependent Claim 22 has been changed to "means for programmably interconnecting" to conform to the amendment of Claim 20. The remaining changes to Claim 22 improve the grammar and clarify the configuration of each interconnect structure.

Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 have been rejected under 35 USC 102(e) as anticipated by Butts et al, U.S. Patent 5,036,473. This rejection is respectfully traversed.

The Examiner has called Applicant's attention to Figs. 3 and 61a - 61c of Butts et al. Upon noting that Butts et al was filed 4 October 1989 as a continuation-in-part of U.S. patent application Ser. No. 07/254,463, filed 5 October 1988, the Examiner says that "A facture inquiry into the application S.N. 07/254,463, the examiner noted that the patent file and the

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'463 application file are identical". The Examiner then alleges that "Thus, the Butts et al reference '473 is qualified as a prior art against the claimed invention".

Butts et al, U.S. Patent 5,036,473, is for convenience generally referred to hereafter as the "Butts 473 patent". Ser. No. 07/254,463, which names Michael Butts as the sole inventor, was abandoned. For convenience, Ser. No. 07/254,463 is generally referred to hereafter as the "abandoned Butts application".

The Examiner's apparent allegation about the patent file for the Butts 473 patent being "identical" to the application file for the abandoned Butts application appears to be incorrect. Well less than 50% of the figures in the Butts 473 patent are present in the abandoned Butts application. Although Applicant's attorney has not compared all of the textual material in the Butts 473 patent to the textual material in the abandoned Butts application, a brief comparison of the two documents indicates that a large portion of the text in the Butts 473 patent does not repeat, or largely repeat, textual material in the abandoned Butts application.

As an example, consider Figs. 61a - 61c which appear in the Butts 473 patent and which the Examiner has specifically called to Applicant's attention. These three figures are discussed at col. 4, line 51, through col. 5, line 67, of the Butts 473 patent. None of Figs. 61a - 61c of the Butts 473 patent is present, or largely present, in the abandoned Butts application. Nor is any of the text at col. 4, line 51, through col. 5, line 67, of the Butts 473 patent present, or largely present, in the abandoned Butts application.

The instant application is a continuation of U.S. patent application Ser. No. 08/171,992, filed 22 December 1993, now U.S. Patent 5,544,069, which is a continuation of U.S. patent application Ser. No. 07/410,194, filed 20 September 1989, now U.S. Patent 5,377,124. 20 September 1989, the filing date of Ser. No. 07/410,194 is, under 35 USC 120, therefore to be accorded to the present application as its effective filing date.

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Assuming arguendo that material which is present in the Butts 473 patent and which repeats, or largely repeats, material in the abandoned Butts application is entitled to be treated as prior art effective the 5 October 1988 filing date of the abandoned Butts application, the 4 October 1989 filing date of the application for the Butts 473 patent is later than the effective filing date of the present application. All of the material which is described in the Butts 473 patent but which is not disclosed, or largely disclosed, in the abandoned Butts application is thus not prior art to the present application. In particular, Figs. 61a - 61c and the related text of the Butts 473 patent are not prior art to the present application.

In addition, part of the specification and drawings of the abandoned Butts application is not carried forward to the Butts 473 patent. Under 35 USC 102(e), a U.S. patent that issues from a U.S. patent application claiming a priority date of an earlier-filed U.S. patent application is, for prior art purposes, to be accorded the filing date of the earlier-filed application only for material common to both the issued patent and the earlier-filed application. Consequently, material disclosed in the abandoned Butts application but not carried forward to the Butts 473 patent is likewise not prior art to the present application.

Assuming arguendo that the material common to the Butts 473 patent and the abandoned Butts application is to be treated as prior art effective the 5 October 1988 filing date of the abandoned Butts application, none of that common material anticipates any of Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 of the present application. To see why this is so, it is convenient to compare Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 to the abandoned Butts application rather than to the Butts 473 patent. Although part of the material in the abandoned Butts application is not carried forward into the Butts 473 patent and thus is not actually prior art to any of Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77, the material present in the abandoned Butts application but not carried forward into the Butts 473 patent

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would not affect the patentability of any of Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 even if that material were prior art to Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77. Accordingly, the following comparison of the abandoned Butts application to Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 is presented without regard to the material not carried forward from the abandoned Butts application to the Butts 473 patent and thus not actually prior art to any of Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77.

First consider the device claims of the instant application.

Independent device Claims 20, 23, 37, and 42 are each directed to a structure containing at least one programmable interconnect chip (again "PIC"), or programmable integrated circuit (also "PIC"), having two sets of conductive leads. Claims 20, 23, 37, and 42 each specify that at least one lead in the two sets of conductive leads comprises, or is divided into, two or more electrically separate conductive segments.

Insofar as what is meant by a lead comprising, or being divided into, two or more electrically separate conductive segments, note that Claims 20, 23, 37, and 42 each provide (a) that the conductive leads in one set of the conductive leads extend in one direction and (b) that the conductive leads in the other set of conductive leads extend in another direction not parallel to the first-mentioned direction. Hence, the electrically separate segments of each segmented conductive lead are situated largely in a straight line with one another. A pair of laterally separated conductive leads extending parallel to (but not in line with) each other, or a pair of conductive leads meeting or crossing each other, are not electrically separate segments of a conductive lead as provided in Claims 20, 23, 37, and 42.

Application Fig. 6b illustrates an example of the present programmable interconnect structure in which certain of the conductive leads are segmented in the manner prescribed in Claims 20, 23, 37, and 42. Horizontal conductive lead 608-1 in Fig. 6b consists of at least

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two electrically separate conductive segments. Short line 618-1 indicates one end of one segment of horizontal lead 608-1. Short lines 618-1 and 618-2 indicate the opposite ends of another segment of horizontal lead 608-1. As shown in Fig. 6b, these two segments of horizontal lead 608-1 are situated in a straight line with one another. Likewise, the two electrically separate conductive segments of vertical conductive lead 609-1 in Fig. 6b are situated in a straight line with one another.

By furnishing a programmable interconnect structure with at least one segmented programmable conductive lead as specified in Claim 20, 23, 37, or 42, the different segments of the programmable lead can be programmed to provide multiple interconnect functions rather than just one interconnect function as occurs with a non-segmented programmable conductive lead. This increases the flexibility and efficiency in implementing circuit designs using the programmable interconnect structure of the invention. Because the conductive leads are utilized more efficiently, the total number of conductive leads can be reduced. The area occupied by the programmable interconnect structure can be reduced, thereby reducing the fabrication cost.

The interconnect function provided by each segment of a segmented programmable conductive lead typically extends over a shorter distance than the interconnect function provided by an unsegmented programmable conductive lead. Consequently, the trade-off for increasing the number of available interconnect functions by utilizing one or more segmented programmable conductive leads is that the interconnect functions provided by the segments of each segmented lead are typically shorter than interconnect functions provided by unsegmented programmable conductive leads.

Many circuit designs need some number of full-length interconnect functions. Accordingly, the selection of the number of programmable conductive leads that are to be

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implemented as segmented leads depends on the typical types of circuit designs to be implemented with the programmable interconnect structure of the invention. As stated in the middle paragraph of page 18 of the specification in regard to the multi-cell configuration of Fig. 6b,

> The particular configuration of the conductive leads extending across one cell and from that cell to adjacent cells depends upon an analysis of the electrical functions to be carried out by the programmable printed circuit board and is selected using the most probable types of system requirements to be imposed on programmable interconnect chip 605. This selection depends upon an analysis of the circuit functions to be performed by the programmable printed circuit board of this invention and thus the actual configuration of the programmable interconnect chip is determined in light of the proposed uses for the programmable printed circuit board.

Also, each segment of a segmented conductive lead has less capacitance than an otherwise equivalent full-length conductive lead. With the capacitive loading reduced, higher operational speed can be achieved. In short, utilization of segmented conductive leads enables the speed and efficiency to be increased while simultaneously enabling the cost to be reduced.

The abandoned Butts application does not disclose how the programmable leads are configured in any of the routing chips or other PICs, let alone that any of the programmable leads comprises, or is divided into, two or more electrically separate conductive segments. Since the abandoned Butts application lacks this disclosure, the Butts 473 patent does not anticipate any of Claims 20, 23, 37, and 42.

Furthermore, nothing in the abandoned Butts application would provide a person skilled in the interconnection art with any motivation or incentive to arrange for a programmable lead to comprise, or be divided into, two or more electrically separate conductive segments in the manner prescribed in each of Claims 20, 23, 37, and 42. Nowhere does the abandoned Butts application indicate any concern with enhancing the internal

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interconnect capability of a routing chip or other PIC in any way remotely similar to what is achieved by the lead segmentation prescribed in claims 20, 23, 37, and 42. Hence, Claims 20, 23, 37, and 42 are patentable over the Butts 473 patent.

Device Claims 21, 22, 24 - 28, 38, and 39 variously depend (directly or indirectly) from Claims 20, 23, and 37. Dependent Claims 21, 22, 24 - 28, 38, and 39 are thus variously patentable over the Butts 473 patent for the same reasons as Claims 20, 23, and 37.

The abandoned Butts application does not disclose the transistor-based programming arrangement of dependent Claim 21. Dependent Claims 22 and 28 disclose a programming arrangement that can be referred to as an antifuse. The abandoned Butts application does not disclose the antifuse programming arrangement of Claim 22 or 28. Nor does the abandoned Butts application disclose the multi-layered board of dependent Claim 38. Claims 21, 22, 28, and 38 are thus separately patentable over the Butts 473 patent.

Dependent Claim 24 recites that the pads are arranged in an area matrix so that at least one of the pads is internal to the pads along the periphery of the area matrix. The abandoned Butts application does not disclose any internal pads and thus does not disclose or suggest the further limitation of Claim 24. Nor does the abandoned Butts application disclose or suggest the specific area-matrix arrangements recited in Claims 25 and 26 which depend from Claim 24. Claims 24 - 26 are likewise separately patentable over the Butts 473 patent.

Independent device Claim 72, which provides that a bus system electrically interconnects a group of PICs, is generally directed to application Fig. 3c in which PICs 321-1 through 321-6 are electrically interconnected through a bus system formed with central bus 323-10 and further buses 323-1 through 323-6. The abandoned Butts application does not disclose the PIC/bus-system architecture of Claim 72. The Butts 473 patent therefore does not anticipate Claim 72.

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In addition, nothing in the abandoned Butts application would lead a person skilled in the interconnection art to the PIC/bus-system architecture of Claim 72. For example, it would be totally illogical to substitute a bus system for any logic chip in diagram 6 of the abandoned Butts application. Accordingly, Claim 72 is patentable over the Butts 473 patent.

Device Claims 73 - 77 depend (directly or indirectly) from Claim 72 and are thus patentable over the Butts 473 patent on the same basis as Claim 72.

The abandoned Butts application does not disclose the multi-layer substrate feature of dependent Claim 73. This makes Claim 73 separately patentable over the Butts 473 patent.

Dependent Claim 75 provides that the bus system comprises a central bus and a group of further buses that respectively connect the central bus to the PICs. The abandoned Butts application does not disclose or suggest anything remotely similar to the bus architecture of Claim 75. Nor does the abandoned Butts application disclose or suggest the further bus architecture limitation of Claim 76 or 77. Hence, Claims 75 - 77 are separately patentable over the Butts 473 patent.

Turning to the method claims, independent method Claim 50 is directed to the operation of a structure that contains at least one PIC having two sets of conductive leads. Claim 50 recites that at least one lead in the two sets of conductive leads is divided into at least two electrically separate conductive segments. As with the segmented conductive leads recited in independent device Claims 20, 23, 37, and 42, the division of a conductive lead into two or more electrically separate conductive segments in method Claim 50 requires that the electrically separate segments of each segmented lead be situated largely in a straight line with one another. As indicated above, the abandoned Butts application does not disclose how programmable leads are configured and thus does not disclose that any programmable lead is

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divided into two or more electrically separate conductive segments. Consequently, the Butts 473 patent does not anticipate Claim 50.

Nor would anything in the abandoned Butts application suggests that a programmable lead be divided into two or more electrically separate conductive segments. Claim 50 is therefore patentable over the Butts 473 patent.

Method Claims 51 and 52 depend from Claim 50 and are thus allowable over the Butts 473 patent for the same reasons as Claim 50.

In short, assuming arguendo that the material common to the Butts 473 patent and the abandoned Butts application is prior art to Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77, none of that common material anticipates any of Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77. More particularly, each of Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 is patentable over this common material even if it were prior art to the present application. Accordingly, Claims 20 - 28, 37 - 39, 42, 50 - 52, and 72 - 77 should be allowed so that the case may proceed to issue.

Please telephone Applicant's attorney at 408-453-9200, ext. 1371, if there are any questions.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: ASSISTANT COMMISSIONER FOR PATENTS, Washington, D.C. 20231, on **March 1, 1999.**

Ronald J. Meetin — 1 Mar. 1999

Attorney for Applicant(s) — Date of Signature

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